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(71)Applicant : **SEIKO EPSON CORP**

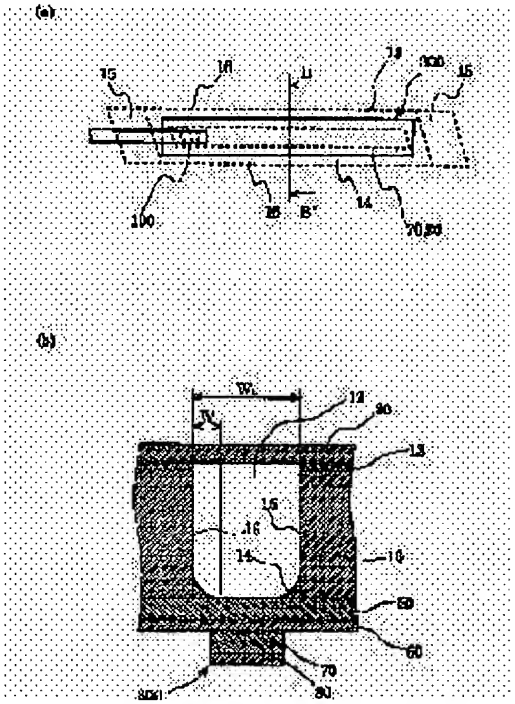
(72)Inventor : **TAKAHASHI TETSUJI**

(54) INK JET RECORDING HEAD, ITS MANUFACTURE AND INK JET RECORDING DEVICE

(57)Abstract:

PROBLEM TO BE SOLVED: To provide an ink jet recording head in which air bubbles are prevented from accumulating in the corner part of a pressure generation chamber, and improvement in discharge of accumulated babbles and the durability of a vibration plate are contrived, and provide further a method for manufacturing the ink jet recording head as well as an ink jet recording device.

SOLUTION: This ink jet recording head comprises a piezoelectric element 300 formed in a region corresponding to a pressure generation chamber 12 through an elastic membrane constituting a part of the pressure generation chamber 12 communicating with a nozzle port by a membrane formation and lithographic process. In this ink jet recording head, an adhesive layer 14 is formed in a corner part formed of the elastic membrane 50 and faces 15, 16 constituting the peripheral wall of the pressure generation chamber 12. Thus it is possible to prevent air bubbles from accumulating in the corner part and enhance the performance of discharge of accumulated bubbles. Further, the durability of the vibration plate is enhanced as the stress concentrating part of the vibration plate is reinforced.



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CLAIMS

[Claim(s)]
[Claim 1] The ink jet type recording head characterized by an adhesives layer existing in the corner formed by said diaphragm and the peripheral wall of said pressure generating room at least in the ink jet type recording head which formed the piezoelectric device in the field corresponding to said pressure generating room by membrane formation and the lithography method through the diaphragm which constitutes a part of pressure generating room formed in the passage formation substrate which is open for free passage to a nozzle orifice.
[Claim 2] The ink jet type recording head which said passage formation substrate is a silicon single crystal substrate of field bearing (110), and is characterized by forming said peripheral wall in respect of four of field bearings (111) in claim 1.
[Claim 3] The ink jet type recording head characterized by forming said pressure generating room in said passage formation substrate of anisotropic etching in claim 2.
[Claim 4] The front face of said adhesives layer which sets they to be [any of claims 1-3], and buries the corner of said diaphragm and the peripheral wall of said pressure generating room is an ink jet type recording head characterized by being a concave configuration.
[Claim 5] The ink jet type recording head to which width of face which set they to be [any of claims 1-4], and met said diaphragm of said adhesives layer is characterized by being 1/3 or less [of the width of face of said pressure generating room].
[Claim 6] The ink jet type recording head characterized by setting they being [any of claims 1-5], and an adhesives layer existing in the corner formed between said peripheral walls.
[Claim 7] The ink jet type recording head characterized by setting they being [any of claims 1-6], and an adhesives layer existing in the corner formed by the closure plate pasted up on the effective area side of said pressure generating room of said passage formation substrate, and said peripheral wall.
[Claim 8] The ink jet type recording head which sets they to be [any of claims 1-7], possesses the passage which opens for free passage the common ink room which supplies ink to said pressure generating room, and said pressure generating room and said common ink room in said passage formation substrate, and is characterized by an adhesives layer existing in said closure plate of said passage, and the field which counters at least.
[Claim 9] The ink jet type recording device characterized by providing which ink jet type recording head of claims 1-8.

[Claim 10] On the elastic membrane of the silicon single crystal substrate which forms a pressure generating room prepared in the field on the other hand, a bottom electrode layer, By carrying out the laminating of a piezo electric crystal layer and the upper electrode layer one by one, and carrying out patterning of each class, to the field corresponding to said pressure generating room Said bottom electrode layer, In the manufacture approach of the ink jet type recording head which forms the piezoelectric device which consists of said piezo electric crystal layer and said upper electrode layer The manufacture approach of the ink jet type recording head characterized by having the process which the adhesives concerned are made to flow into the corner formed by the elastic membrane which constitutes said a part of pressure generating room, and the peripheral wall, and forms an adhesives layer while pasting up a closure plate on the opening side face of said silicon single crystal substrate.
[Claim 11] The manufacture approach of the ink jet type recording head characterized by supplying superfluous adhesives between said silicon single crystal substrates and said closure plates, making it flow into said corner at least, and forming said adhesives layer in claim 10 in case said closure plate is pasted up.
[Claim 12] The manufacture approach of the ink jet type recording head characterized by making it flow into said corner which supplies adhesives to the corner formed in claim 10 by the peripheral walls which form said pressure generating room, and is formed by said elastic membrane and peripheral wall, and forming said adhesives layer.

[Claim 13] The manufacture approach of the ink jet type recording head characterized by rotating said silicon single crystal substrate in a field, making adhesives flow into said corner at least, and forming said adhesives layer in claim 10 after supplying adhesives to said pressure generating interior of a room.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention constitutes a part of nozzle orifice which carries out the regurgitation of the ink droplet, and pressure generating room open for free passage from a diaphragm, prepares a piezoelectric device through this diaphragm, and relates to an ink jet type recording device at the ink jet type recording head which makes an ink droplet breathe out with the variation rate of this piezoelectric device, and its manufacture approach list.
[0002]
[Description of the Prior Art] A part of nozzle orifice which carries out the regurgitation of the ink droplet, and pressure generating room open for free passage are constituted from a diaphragm, and two kinds are put in practical use by the ink jet type recording head which makes this diaphragm transform by the piezoelectric device, and the ink of a pressure generating room is pressurized [recording head], and makes an ink droplet breathe out from a nozzle orifice although what used the piezoelectric device in the longitudinal-oscillation mode elongated and contracted, and the piezoelectric device of the bending oscillation mode were used for the shaft orientations of a piezoelectric device.
[0003] The former can change the volume of a pressure generating room by making the end face of a piezoelectric device contact a diaphragm, and while manufacture of the head suitable for high density printing is possible, a piezoelectric device is made in agreement with the array pitch of a nozzle orifice, the difficult process of carving in the shape of a ctenidium, and the activity which positions the piezoelectric device which was able to be carved in a pressure generating room, and is fixed are needed, and it has the problem that a production process is complicated.
[0004] On the other hand, the green sheet of piezoelectric material is stuck according to the configuration of a pressure generating room, a certain amount of area is needed for a diaphragm at the comparatively easy process of calcinating this, on the relation using bending vibration of what can fix a piezoelectric device, and the latter has the problem that a high density array is difficult.
[0005] On the other hand, that it should cancel un-arranging [of the latter recording head], what formed the piezoelectric device so that might continue on the surface of [whole] a diaphragm, a uniform piezoelectric-material layer might be formed with a membrane formation technique, this piezoelectric-material layer might be carved into the configuration corresponding to a pressure generating room by the lithography method and it might become independent for every pressure generating room is proposed so that JP,5-286131,A may see.
[0006] There is an advantage it not only can fix a piezoelectric device by the simple technique of the lithography method precisely, but that the activity which sticks a piezoelectric device on a diaphragm becomes unnecessary according to this, and can make thickness of a piezoelectric device thin and a high-speed drive is attained. In addition, the piezoelectric device corresponding to each pressure generating room can be driven by preparing only an upper electrode for every pressure generating room at least, preparing a piezoelectric-material layer on the surface of [whole] a diaphragm in this case.
[0007]
[Problem(s) to be Solved by the Invention] However, by the manufacture approach by the thin film technology and the lithography method which were mentioned above, although a pressure generating room is formed after patterning of a thin film, since the corner of a pressure generating room is formed in the acute angle, air bubbles tend to collect and there is a problem that eccritic [of the collected air bubbles] is bad and has a bad influence on the ink regurgitation.
[0008] This invention makes it a technical problem to provide with an ink jet type recording device the ink jet type recording head which aimed at prevention of cellular ******, and eccritic improvement in air bubbles, and its manufacture approach list in view of such a situation.
[0009]

[Means for Solving the Problem] The 1st mode of this invention which solves the above-mentioned technical problem is in the ink-jet type recording head characterized by for an adhesives layer to exist in the corner formed by said diaphragm and the peripheral wall of said pressure generating room at least in the ink-jet type recording head which formed a piezoelectric device in the field corresponding to said pressure generating room by membrane formation and the lithography method through the diaphragm which constitutes a part of pressure generating room formed in the passage formation substrate which is open for free passage to a nozzle orifice.
[0010] It is prevented that air bubbles collect on the corner of a pressure generating room, and the stress concentration part of a diaphragm is reinforced with this 1st mode by the adhesives layer.
[0011] In the 1st mode, said passage formation substrate is a silicon single crystal substrate of field bearing (110), and the 2nd mode of this invention is in the ink jet type recording head characterized by forming said peripheral wall in respect of four of field bearings (111).
[0012] In this 2nd mode, although the corner of a pressure generating room is formed keenly, air bubbles do not collect by the adhesives layer.
[0013] The 3rd mode of this invention is in the ink jet type recording head characterized by forming said pressure generating room in said passage formation substrate of anisotropic etching in the 2nd mode.
[0014] In this 3rd mode, the ink jet type recording head which has the nozzle orifice of high density can be manufactured in large quantities and comparatively easily.
[0015] the 4th mode of this invention -- which 1-3rd voice -- it sets like and the front face of said adhesives layer which buries the corner of said diaphragm and the peripheral wall of said pressure generating room is in the ink jet type recording head characterized by being a concave configuration.
[0016] In this 4th mode, cellular ****** to the corner of a pressure generating room is prevented certainly.
[0017] the 5th mode of this invention -- which 1-4th voice -- it sets like and the width of face which met said diaphragm of said adhesives layer is in the ink jet type recording head characterized by being 1/3 or less [of the width of face of said pressure generating room].
[0018] In this 5th mode, an adhesives layer does not have a bad influence on vibration of a diaphragm.
[0019] The 6th mode of this invention is in the ink jet type recording head characterized by an adhesives layer existing in the corner formed between said peripheral walls in which 1-5th modes.
[0020] In this 6th mode, cellular ****** of a pressure generating room is prevented still more certainly.
[0021] the 7th mode of this invention -- which 1-6th voice -- it sets like and is in the ink jet type recording head characterized by an adhesives layer existing in the corner formed by the closure plate pasted up on the effective area side of said pressure generating room of said passage formation substrate, and said peripheral wall.
[0022] In this 7th mode, cellular ****** of a pressure generating room is prevented still more certainly.
[0023] the 8th mode of this invention -- which 1-7th voice -- it sets like, the passage which opens for free passage the common ink room which supplies ink to said pressure generating room, and said pressure generating room and said common ink room is provided in said passage formation substrate, and it is in the ink jet type recording head characterized by an adhesives layer existing in said closure plate of said passage, and the field which counters at least.
[0024] In this 8th mode, the flow of the ink from a common ink room to a pressure generating room becomes good.
[0025] The 9th mode of this invention is in the ink jet type recording device characterized by providing the ink jet type recording head of which 1-8th modes.
[0026] In this 9th mode, the ink jet type recording device by which cellular ****** of the corner of a pressure generating room was prevented is realizable.
[0027] The 10th mode of this invention on the elastic membrane of the silicon single crystal substrate which forms a pressure generating room prepared in the field on the other hand A bottom electrode layer, By carrying out the laminating of a piezo electric crystal layer and the upper electrode layer one by one, and carrying out patterning of each class, to the field corresponding to said pressure generating room Said bottom electrode layer, In the manufacture approach of the ink jet type recording head which forms the piezoelectric device which consists of said piezo electric crystal layer and said upper electrode layer While pasting up a closure plate on the opening side face of said silicon single crystal substrate, it is in the manufacture approach of the ink jet type recording head characterized by having the process which the adhesives concerned are made to flow into the corner formed by the elastic membrane which constitutes said a part of pressure generating room, and the peripheral wall, and forms an adhesives layer.
[0028] An adhesives layer can be formed in the corner of a pressure generating room in this 10th mode.
[0029] In the 10th mode, in case the 11th mode of this invention pastes up said closure plate, it supplies superfluous adhesives between said silicon single crystal substrates and said closure plates, and is in the manufacture approach of the ink jet type recording head characterized by making it flow into said corner at least, and forming said adhesives

layer.
[0030] In this 11th mode, an adhesives layer can be easily formed in the corner of a pressure generating room.
[0031] The 12th mode of this invention is in the manufacture approach of the ink jet type recording head characterized by making it flow into said corner which supplies adhesives to the corner formed by the peripheral walls which form said pressure generating room, and is formed by said elastic membrane and peripheral wall, and forming said adhesives layer in the 10th mode.
[0032] In this 12th mode, the adhesives supplied to the corner between peripheral walls flow into the corner between elastic membrane and a peripheral wall, and form an adhesives layer.
[0033] In the 10th mode, the 13th mode of this invention is in the manufacture approach of the ink jet type recording head characterized by rotating said silicon single crystal substrate in a field, making adhesives flow into said corner at least, and forming said adhesives layer, after supplying adhesives to said pressure generating interior of a room.
[0034] In this 13th mode, the adhesives supplied to the pressure generating interior of a room gather for the corner between elastic membrane and a peripheral wall according to a centrifugal force, and form an adhesives layer.
[0035]
[Embodiment of the Invention] This invention is explained at a detail based on an operation gestalt below.
[0036] (Operation gestalt 1) Drawing 1 is the decomposition perspective view showing the ink jet type recording head concerning the operation gestalt 1 of this invention, and drawing 2 is drawing showing the cross-section structure in the longitudinal direction of a top view and its one pressure generating room.
[0037] The passage formation substrate 10 consists of a silicon single crystal substrate of field bearing (110) with this operation gestalt so that it may illustrate. As a passage formation substrate 10, a thing with a thickness of about 150-300 micrometers is used, and about 180-280 micrometers of things with a thickness of about 220 micrometers are usually more desirably suitable desirably. This is because an array consistency can be made high, maintaining the rigidity of the septum between adjoining pressure generating rooms.
[0038] One field of the passage formation substrate 10 turns into an effective area, and the elastic membrane 50 with a thickness of 0.1-2 micrometers which consists of diacid-ized silicon beforehand formed by thermal oxidation is formed in the field of another side.
[0039] On the other hand, the nozzle orifice 11 and the pressure generating room 12 are formed in the effective area of the passage formation substrate 10 by carrying out anisotropic etching of the silicon single crystal substrate.
[0040] If anisotropic etching is immersed in alkali solutions, such as a potassium hydroxide, a silicon single crystal substrate here It is eaten away gradually and nothing, and the above-mentioned (110) field and the 2nd field (111) which makes the include angle of about 35 degrees appear the 1st field (111) perpendicular to a field (110), this 1st field (111), and the include angle of about 70 degrees. (110) It is carried out using the property in which the etching rate of a field (111) is about 1/180 as compared with the etching rate of a field. By this anisotropic etching, precision processing can be performed on the basis of depth processing of the shape of the 1st two field (111) and a parallelogram formed in respect of [slanting / two] the 2nd (111), and the pressure generating room 12 can be arranged to high density.
[0041] The long side of each pressure generating room 12 is formed, and the shorter side is formed in respect of the 2nd (111) in respect of the 1st (111) with this operation gestalt. This pressure generating room 12 is formed by etching until it penetrates the passage formation substrate 10 mostly and reaches elastic membrane 50. In addition, elastic membrane 50 has the very small amount invaded by the alkali solution which etches a silicon single crystal substrate.
[0042] On the other hand, each nozzle orifice 11 which is open for free passage at the end of each pressure generating room 12 is formed more shallowly [narrow] than the pressure generating room 12. That is, the nozzle orifice 11 is formed by etching a silicon single crystal substrate in the thickness direction to the middle (half etching). In addition, half etching is performed by adjustment of etching time.
[0043] Here, the magnitude of the pressure generating room 12 which gives an expulsion-of-an-ink-droplet pressure to ink, and the magnitude of the nozzle orifice 11 which carries out the regurgitation of the ink droplet are optimized according to the amount of the ink droplet which carries out the regurgitation, regurgitation speed, and a regurgitation frequency. For example, when recording 360 ink droplets per inch, it is necessary to form a nozzle orifice 11 with a sufficient precision with the flute width of dozens of micrometers.
[0044] Moreover, each pressure generating room 12 and the common ink room 31 mentioned later are opened for free passage through the ink supply free passage opening 21 formed in the location corresponding to the end section of each pressure generating room 12 of the closure plate 20 mentioned later, respectively, and ink is supplied from the common ink room 31 through this ink supply free passage opening 21, and is distributed to each pressure generating room 12.
[0045] The closure plate 20 consists of crystallized glass with which the ink supply free passage opening 21

corresponding to each above-mentioned pressure generating room 12 was drilled and which thickness is 0.1-1mm, and coefficient of linear expansion is 300 degrees C or less, for example, is 2.5-4.5 [x10-6/degree C]. In addition, the ink supply free passage opening 21 may be two or more slit [A / which crosses near the ink supply side edge section of each pressure generating room 12 / one slit hole 21] hole 21B, as shown in drawing 3 (a) and (b). The closure plate 20 covers the whole surface of the passage formation substrate 10 extensively in respect of one side, and the duty of the back up plate which protects a silicon single crystal substrate from an impact or external force also achieves it. Moreover, on the other hand, the closure plate 20 comes out, and constitutes one wall surface of the common ink room 31.

[0046] The common ink room formation substrate 30 forms the peripheral wall of the common ink room 31, and pierces and produces the stainless plate of proper thickness according to nozzle numerical aperture and an expulsion-of-an-ink-droplet frequency. With this operation gestalt, thickness of the common ink room formation substrate 30 is set to 0.2mm.

[0047] The ink room side plate 40 consists of a stainless steel substrate, and constitutes one wall surface of the common ink room 31 from one field. Moreover, by forming crevice 40a in a part of field of another side by half etching, a thin wall 41 is formed in the ink room side plate 40, and the ink inlet 42 which receives the ink supply from the outside is further pierced and formed in it. In addition, a thin wall 41 is for absorbing the nozzle orifice 11 generated in the case of expulsion of an ink droplet, and the pressure which goes to the opposite side, and prevents that forward [unnecessary] or negative pressure joins other pressure generating rooms 12 via the common ink room 31. Although the ink room side plate 40 is set to 0.2mm and the part is used as the thin wall 41 with a thickness of 0.02mm with this operation gestalt in consideration of rigidity required at the time of connection between the ink inlet 42 and an external ink supply means etc., in order to omit formation of the thin wall 41 by half etching, it is good also as 0.02mm from the start in the thickness of the ink room side plate 40.

[0048] On the other hand, with the effective area of the passage formation substrate 10, on the elastic membrane 50 of the opposite side, laminating formation is carried out in the process which thickness mentions [thickness] later with the bottom electrode layer 60 which is about 0.5 micrometers, and the upper electrode layer 80 which is about 0.1 micrometers mentions [the piezo electric crystal film 70 which is about 1 micrometer, and thickness] later, and the piezoelectric device 300 is constituted. Here, a piezoelectric device 300 says the part containing the bottom electrode layer 60, the piezo electric crystal film 70, and the upper electrode layer 80. Generally, one electrode of the piezoelectric devices 300 is used as a common electrode, every pressure generating room 12, patterning of the electrode and the piezo electric crystal film 70 of another side is carried out, and they are constituted. Moreover, an electrostrictive actuator is called here together with the diaphragm which a variation rate produces by the drive of a piezoelectric device 300 and the piezoelectric device 300 concerned. In addition, although elastic membrane 50 and the bottom electrode layer 60 act as a diaphragm, you may make it the bottom electrode layer 60 serve as elastic membrane 50 with this operation gestalt.

[0049] Here, the process which forms piezo electric crystal film 70 grade on the passage formation substrate 10 which consists of a silicon single crystal substrate is explained, referring to drawing 4 .

[0050] As shown in drawing 4 (a), the elastic membrane 50 which oxidizes thermally the wafer of the silicon single crystal substrate used as the passage formation substrate 10 with about 1100-degree C diffusion furnace first, and consists of diacid-ized silicon is formed.

[0051] Next, as shown in drawing 4 (b), the bottom electrode layer 60 is formed by sputtering. As an ingredient of the bottom [this] electrode layer 60, platinum etc. is suitable. The below-mentioned piezo electric crystal film 70 which this forms with sputtering or a sol-gel method is because it is necessary to make it calcinate and crystallize at the temperature of about 600-1000 degrees C under an atmospheric-air ambient atmosphere or an oxygen ambient atmosphere after membrane formation. That is, when conductivity must be able to be held under such an elevated temperature and an oxidizing atmosphere and titanic-acid lead zirconate is especially used as piezo electric crystal film 70, as for the ingredient of the bottom electrode layer 60, it is desirable for there to be little conductive change by diffusion of lead oxide, and platinum is suitable for it from these reasons.

[0052] Next, as shown in drawing 4 (c), the piezo electric crystal film 70 is formed. With this operation gestalt, spreading desiccation is carried out, the so-called sol which dissolved and distributed the metal organic substance at the solvent is gelled, and the so-called sol-gel method which obtains the piezo electric crystal film 70 which consists of a metallic oxide by calcinating at an elevated temperature further is used. As an ingredient of the piezo electric crystal film 70, when the ingredient of a titanic-acid lead zirconate (PZT) system uses it for an ink jet type recording head, it is suitable. In addition, especially the membrane formation approach of this piezo electric crystal film 70 is not limited, for example, may be formed by the sputtering method.

[0053] Furthermore, the approach of carrying out crystal growth at low temperature with the high-pressure approach in the inside of an alkali water solution after forming the precursor film of titanic-acid lead zirconate by the sol-gel method or the sputtering method may be used.
[0054] Next, as shown in drawing 4 (d), the upper electrode layer 80 is formed. The upper electrode layer 80 can use a metal, a conductive oxide, etc. of many, such as aluminum, gold, nickel, and platinum, that what is necessary is just a conductive high ingredient. With this operation gestalt, platinum is formed by sputtering.
[0055] next, it is shown in drawing 5 (a) -- as -- each pressure generating room 12 -- patterning of the piezo electric crystal film 70 and the upper electrode layer 80 is performed so that it is alike, respectively, and it may receive and a piezoelectric device may be arranged. Although drawing 5 (a) shows the case where the same pattern as the upper electrode 80 performs patterning for the piezo electric crystal film 70, as mentioned above, the piezo electric crystal film 70 does not necessarily need to perform patterning. When this uses the pattern of the upper electrode layer 80 as an individual electrode and an electrical potential difference is impressed, it is only starting between each upper electrode 80 and the bottom electrode layer 60 which is a common electrode, and electric field are for not affecting other parts at all. However, since electrical-potential-difference impression big in order to obtain the same excluded volume in this case is needed, also as for the piezo electric crystal film 70, it is desirable to carry out patterning. Moreover, after this, patterning of the bottom electrode layer 60 is carried out, and an unnecessary part is removed.
[0056] Subsequently, as shown in drawing 5 (b), after carrying out patterning of the piezo electric crystal film 70 and the upper electrode layer 80, the insulator layer 90 equipped with electric insulation so that the top face of each up electrode layer 80 and the side face of the piezo electric crystal film 70 might be covered is formed.
[0057] And the lead electrode 100 with which contact hole 90a to which a part of upper electrode layer 80 is exposed is formed in order to connect the top face of the part corresponding to the end section of each piezoelectric device 300 of the insulator layer 90 with the lead electrode 100 later mentioned into a part of wrap part, as shown in drawing 5 (c), an end connects with each up electrode layer 80 through this contact hole 90a, and the other end is prolonged in a connection terminal area is formed. The lead electrode 100 is formed so that it may become narrow width of face as much as possible to extent which can supply a driving signal to the upper electrode layer 80 certainly.
[0058] Thus, after performing film formation, as shown in drawing 5 (d), anisotropic etching of the silicon single crystal substrate by the alkali solution mentioned above is performed, and pressure generating room 12 grade is formed.

[0059] A series of film formation and anisotropic etching which were explained above form much chips on one wafer at coincidence, and divide them after process termination every passage formation substrate 10 of one chip size as shown in drawing 1 . Moreover, sequential adhesion is carried out with the closure plate 20, the common ink room formation substrate 30, and the ink room side plate 40, and it unifies, and let the divided passage formation substrate 10 be an ink jet type recording head.
[0060] Thus, the important section front view of the formed pressure generating room is shown in drawing 6 (a), and an important section sectional view is shown in drawing 6 (b). In case the closure plate 20 is pasted up on the passage formation substrate 10, the thermosetting adhesive 13 of the suitable amount for the opening side face of the passage formation substrate 10 is applied, and the closure plate 20 is made to stick by pressure.
[0061] Four fields of field bearing (111) where the pressure generating room 12 was formed in the passage formation substrate 10, That is, it is formed by the longitudinal direction side attachment wall 15 and the crosswise side attachment wall 16, and the adhesives which flowed out at this time flow into the corner between elastic membrane 50 and the longitudinal direction side attachment wall 15, and the corner between elastic membrane 50 and the crosswise side attachment wall 16, harden by [that] carrying out afterbaking, and form the adhesives layer 14.
[0062] Moreover, it may use that the longitudinal direction side attachment wall 15 is formed with the include angle of about 35 degrees to elastic membrane 50, adhesives may be supplied to the corner between the longitudinal direction side attachment wall 15 and the crosswise side attachment wall 16, and adhesives may be made to flow into the corner between elastic membrane 50 and the longitudinal direction side attachment wall 15, and the corner between elastic membrane 50 and the crosswise side attachment wall 16.
[0063] Adhesives may be supplied in the pressure generating room 12, the passage formation substrate 10 may be horizontally rotated in a field further again, and adhesives may be made to flow into the corner between elastic membrane 50 and the longitudinal direction side attachment wall 15, and the corner between elastic membrane 50 and the crosswise side attachment wall 16 according to a centrifugal force.
[0064] Thus, the formed adhesives layer 14 is effective in preventing cellular ****** in the corner of the pressure generating room 12, and eccritic [its / of air bubbles] improves.
[0065] Such an adhesives layer 14 may be formed in the corner between the longitudinal direction side attachment wall

15 and the crosswise side attachment wall 16, the corner between the closure plate 20 and the longitudinal direction side attachment wall 15, and the corner between the closure plate 20 and the crosswise side attachment wall 16, and has the same effectiveness as the above.

[0066] Moreover, although stress concentration occurred in the elastic membrane 50 near a corner conventionally with the big variation rate of the elastic membrane 50 by the drive of a piezoelectric device, by forming the adhesives layer 14 in a corner, elastic membrane 50 is reinforced and the effectiveness that endurance improves also does so.

[0067] As for such an adhesives layer 14, it is desirable that the surface configuration has constituted the concave configuration, and further, it does not have a bad influence on vibration of a diaphragm as the width of face W which met the elastic membrane 50 of an adhesives layer is 1/3 or less [of the width of face Wc of the pressure generating room 12].

[0068] Thus, the constituted ink jet head Ink is incorporated from the ink inlet 42 linked to the external ink supply means which is not illustrated. After filling the interior with ink until it results [from the common ink room 31] in a nozzle orifice 11, By impressing an electrical potential difference between the bottom electrode 60 and the upper electrode 80 through the lead electrode 100, bending and making elastic membrane 50, the bottom electrode 60, and the piezo electric crystal layer 70 deform according to the record signal from the drive circuit of the exterior which is not illustrated The pressure in the pressure generating room 12 increases, and an ink droplet carries out the regurgitation from a nozzle orifice 11.

[0069] (Operation gestalt 2) Drawing 7 is the important section sectional view of the operation gestalt 2 of this invention.

[0070] This example is the ink jet head of the gestalt which formed the common ink room 17 which supplies ink to the pressure generating room 12 in the passage formation substrate 10, makes adhesives flow also into the closure plate of the passage 18 which opens the pressure generating room 12 and the common ink room 17 for free passage, and the field which counters in addition to the adhesives layer of the operation gestalt 1, and forms the adhesives layer 19.

[0071] In order that passage 18 may carry out half etching and may form the part concerned of the passage formation substrate 10 by predetermined Mr. Fukashi, as for the closure plate and the passage side which counters, the front face is coarse comparatively. For this reason, in this example, by forming the adhesives layer 19 also in the closure plate of the passage 18 which opens the pressure generating room 12 and the common ink room 17 for free passage, and the field which counters, the closure plate of passage 18 and the field which counters are graduated, and the fluid improvement of the ink from the common ink room 17 to the pressure generating room 12 is aimed at.

[0072] Moreover, there is instead of [no] in effectiveness being in prevention of cellular ****** of the pressure generating room 12, and the eccritic improvement in air bubbles, and reinforcing the stress concentration part of elastic membrane 50 with this operation gestalt as well as the operation gestalt 1, and endurance improving with it.

[0073] (Other operation gestalten) Although each operation gestalt of this invention was explained above, the fundamental configuration of an ink jet type recording head is not limited to what was mentioned above.

[0074] For example, it is good also considering the common ink room formation plate 30 besides the closure plate 20 mentioned above as a product made from crystallized glass, and it is still better also as a product made from crystallized glass, using the light-gage film 41 as another member, and modification of an ingredient, structure, etc. is free.

[0075] Moreover, with the operation gestalt mentioned above, although the nozzle orifice is formed in the end face of the passage formation substrate 10, the nozzle orifice which projects in the direction perpendicular to a field may be formed.

[0076] Thus, it is ********** to drawing 9 about the cross section of drawing 8 and its passage in the decomposition perspective view of the constituted operation gestalt. With this operation gestalt, a nozzle orifice 11 is drilled by the nozzle substrate 120 opposite to a piezoelectric device, and the nozzle free passage opening 22 which opens these nozzle orifices 11 and the pressure generating room 12 for free passage is arranged so that the closure plate 20, the common ink room formation plate 30, light-gage plate 41A, and ink room side plate 40A may be penetrated.

[0077] In addition, it is the same as that of the operation gestalt fundamentally mentioned above except this operation gestalt having, used light-gage plate 41A and ink room side plate 40A as another member in addition to this, and having formed opening 40b in the ink room side plate 40, and the explanation which gives the same sign to the same member and overlaps is omitted.

[0078] Like the operation gestalt mentioned above, by forming the adhesives layer 14 in the corner of a pressure generating room, cellular ****** of a corner is prevented and eccritic [of air bubbles] improves also in this operation gestalt. Moreover, the stress concentration part of elastic membrane 50 is reinforced, and the endurance of elastic membrane 50 can be improved.

[0079] Moreover, of course, it is applicable also like the ink jet type recording head of the type in which the common ink room was formed in the passage formation substrate.
[0080] Moreover, although each operation gestalt explained above made the example the ink jet type recording head of the thin film mold which can be manufactured by applying membrane formation and a lithography process, of course, it is not limited to this and can adopt this invention as the ink jet type recording head of various kinds of structures, such as a thing which forms the piezo electric crystal film by screen-stencil etc., or a thing which forms the piezo electric crystal film with crystal growth.
[0081] Furthermore, although the example which prepared the insulator layer between the piezoelectric device and the lead electrode was explained, it is good also as a configuration which carries out heat welding of the anisotropy electric conduction film, connects this anisotropy electric conduction film with a lead electrode, or is connected to each up electrode in addition to this using various bonding techniques, such as wirebonding, without not being limited to this, for example, preparing an insulator layer.
[0082] Thus, this invention is applicable to the ink jet type recording head of various structures, unless it is contrary to the meaning.
[0083] Moreover, the ink jet type recording head of each [these] operation gestalt constitutes a part of recording head unit possessing an ink cartridge etc. and ink passage open for free passage, and is carried in an ink jet type recording device. Drawing 10 is the schematic diagram showing an example of the ink jet type recording device.
[0084] As shown in drawing 10 , the carriage 3 which was formed removable and carried these recording head units 1A and 1B is formed free [shaft-orientations migration on the carriage shaft 5 with which cartridge 2A and 2B from which the recording head units 1A and 1B which have an ink jet type recording head constitute an ink supply means were attached in the body 4 of equipment]. These recording head units 1A and 1B shall carry out the regurgitation of a black ink constituent and the color ink constituent, respectively, for example.
[0085] And the carriage 3 which carried the recording head units 1A and 1B is moved in accordance with the carriage shaft 5 by being transmitted to carriage 3 through two or more gearings and timing belts 7 which the driving force of a drive motor 6 does not illustrate. On the other hand, along with carriage 3, the platen 8 is formed in the body 4 of equipment. Record sheet S which is record media, such as paper to which can rotate now with the driving force of the paper feed motor which is not illustrated, and paper was fed with the feed roller etc., winds this platen 8 around a platen 8, it is hung, and is conveyed.
[0086]
[Effect of the Invention] As explained above, according to this invention, by preparing an adhesives layer in the corner of a pressure generating room, eccritic [of the air bubbles with which it was prevented that air bubbles collect on the corner of a pressure generating room, and it collected] improves, and the ink regurgitation becomes good. Furthermore, the stress concentration part of a diaphragm is reinforced and the endurance of a diaphragm also improves.

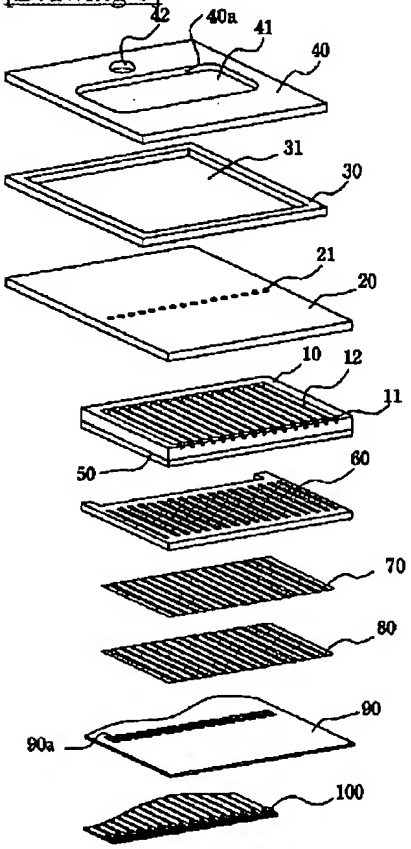
[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

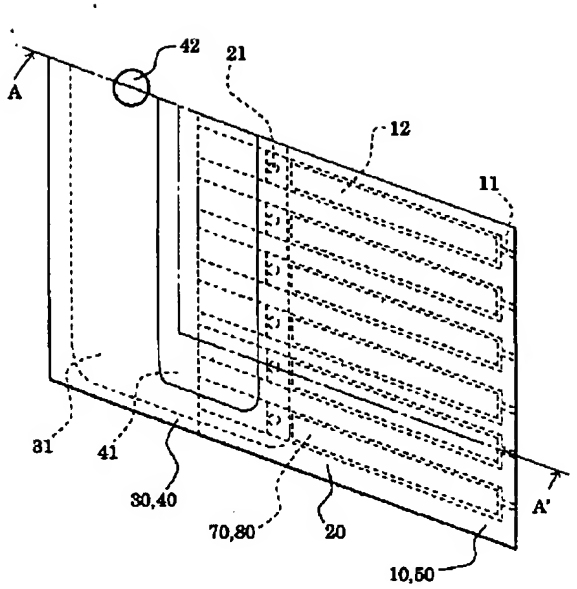
DRAWINGS

[Drawing 1]

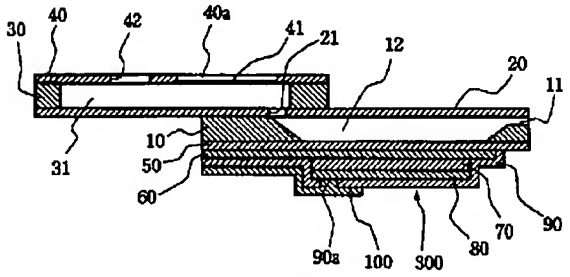


[Drawing 2]

(a)

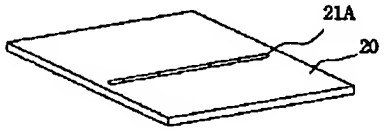


(b)



[Drawing 3]

(a)



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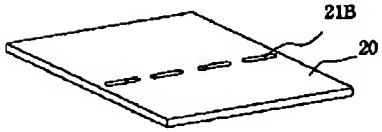
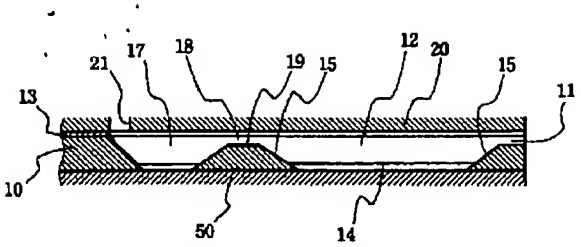
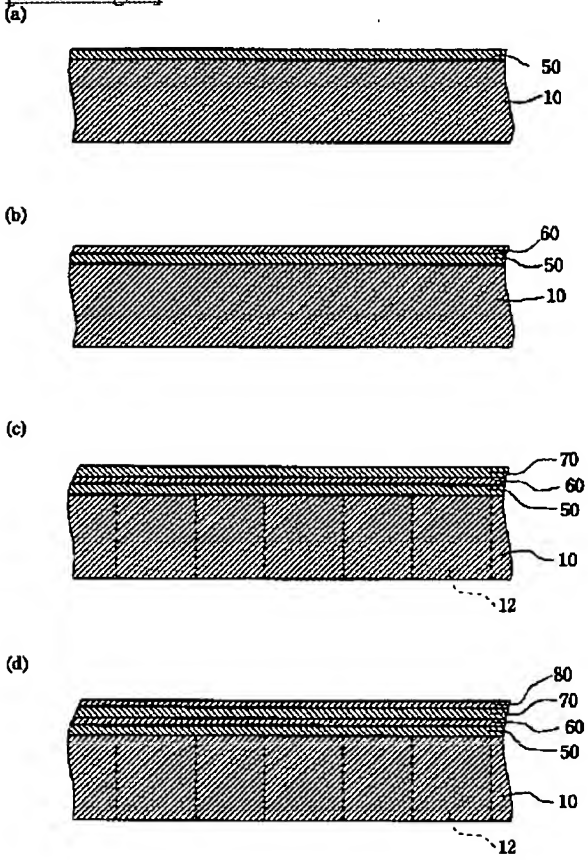


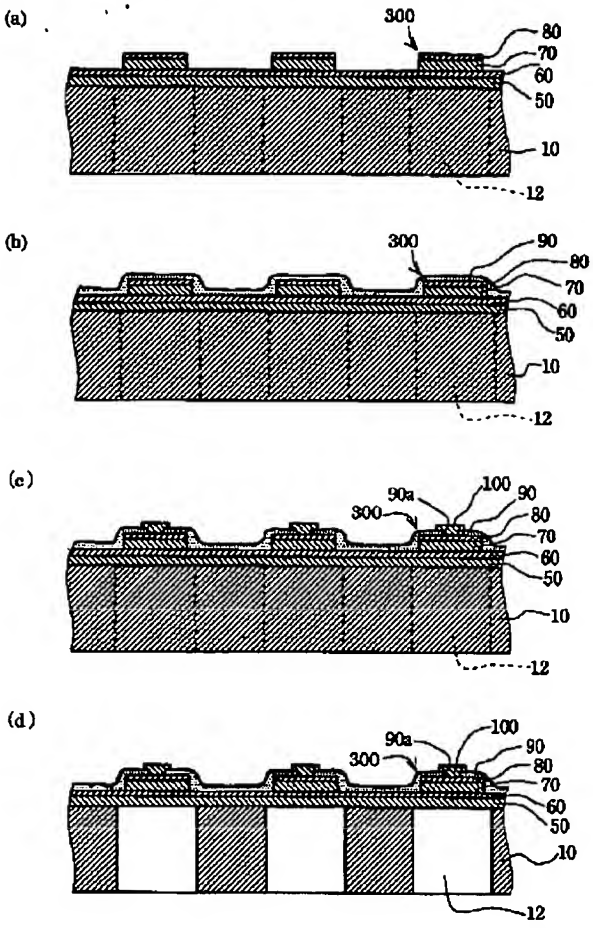
[Drawing 7]



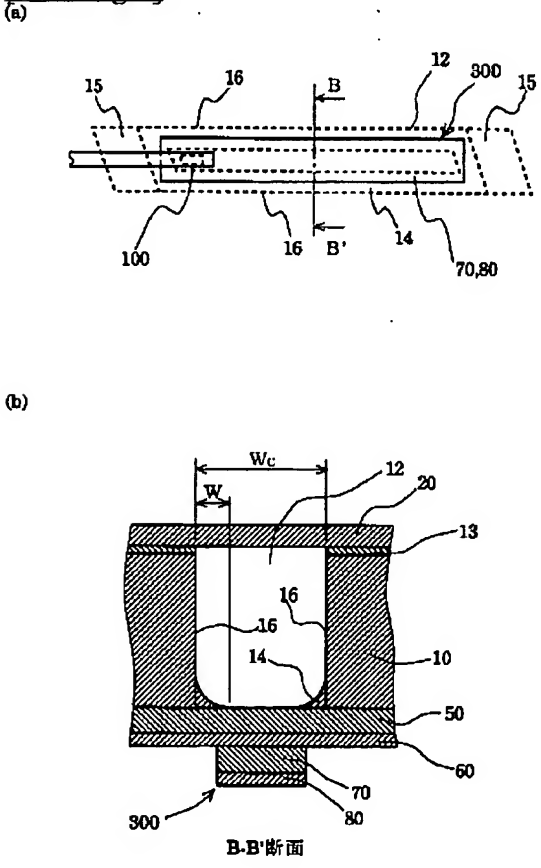
[Drawing 4]



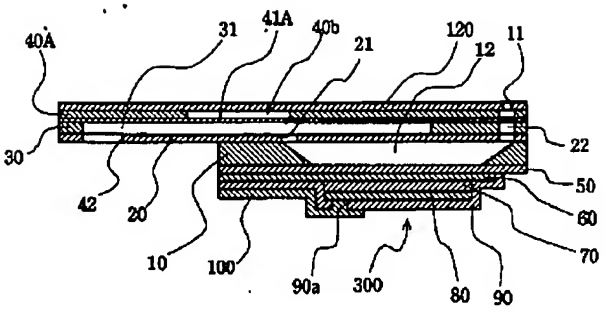
[Drawing 5]



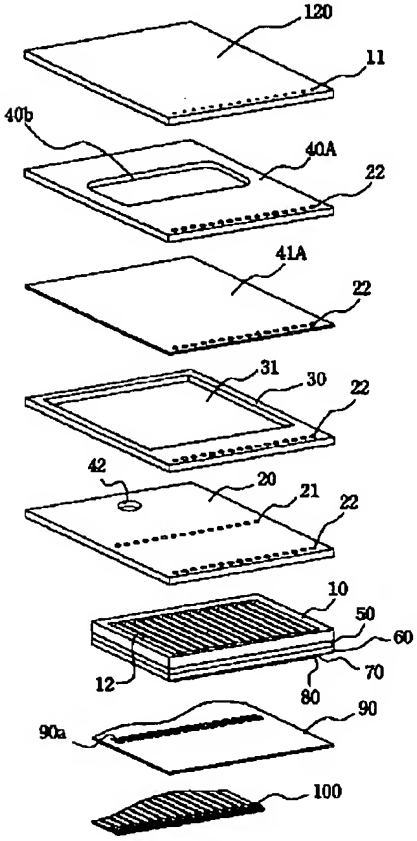
[Drawing 6]



[Drawing 9]



[Drawing 8]



[Drawing 10]